Requirements Engineering Supporting Process

The Project Office must accurately and clearly define and manage the system requirements. The requirements form the basis for the system and should clearly describe the user's needs and priorities. Requirements are generally defined during the early procurement phase, baselined and then incorporated or referenced in the **Request for Proposal (RFP)**. Requirements engineering continues into the **Maintenance and Operations (M&O) phase** as new requirements are added or existing requirements are changed.

Requirements are usually the responsibility of the project's requirements engineers, and must include user representatives. The project's IV&V usually performs or participates in the validation and traceability processes at a minimum.

The following are the basic elements of requirements engineering:

- **Requirements Definition**
  - **Elicitation**
  - **Analysis**
  - **Documentation**
    - System Requirements Specification (SyRS)
    - Concept of Operations (ConOps)
    - Interface Requirements Specification (IRS)
    - Software Requirements Specification (SRS)
  - **Validation**
- Requirements Management
  - **Requirements Change Control**
  - **Traceability**

It is generally recommended that an **automated tool** be used to assist with tracking and reporting on requirements traceability and stability.

References

- IEEE **830-1998** (link to pdf), Recommended Practice for Developing Software Requirements Specifications (SRS)
- IEEE **1233-1998** (link to pdf), Guide for Developing System Requirements Specifications (SyRS)
- IEEE **12207.0-1996** (link to pdf), Standard for Information Technology Software Life Cycle Processes, March 98, paragraph 5.1.1
- SEI's **SA-CMM** (pdf), Key Practice Area 2.3 - Requirements Management
- **International Council Of Systems Engineering (INCOSE)** (link). This website is a great source of information related to Systems Engineering activity in the industry. They have a requirements working group that publishes a variety of papers on the subject. The following are particularly useful.
  - **"Characteristics of Good Requirements" Information Report**, 1996 (pdf)
  - **"Writing Good Requirements" Information Report**, 1993 (pdf)

Suggested Reading

- Software Requirements (book), Karl Wiegers, Microsoft Press, 1999
- **Requirement Management Tool Market Survey**, SID, Feb 2000 (pdf)
- **Getting Connected Workshop: Requirements Definition**, March 2003 (pdf)
- **Getting Connected Workshop: Requirements Management**, March 2003 (pdf)

Samples

- **CalWIN Requirements Management Process** (pdf) - Focuses on requirements development and validation
- **EBT Requirements Traceability Plan** (MS Word) - Focuses on monitoring requirements
  - **Appendix A - RequisitePro Schema** (MS Word)
  - **Appendix B - Baseline Operational Requirements** (MS Word)
  - **Appendix C - Contract Requirements** (MS Word)

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Requirements Development Overview

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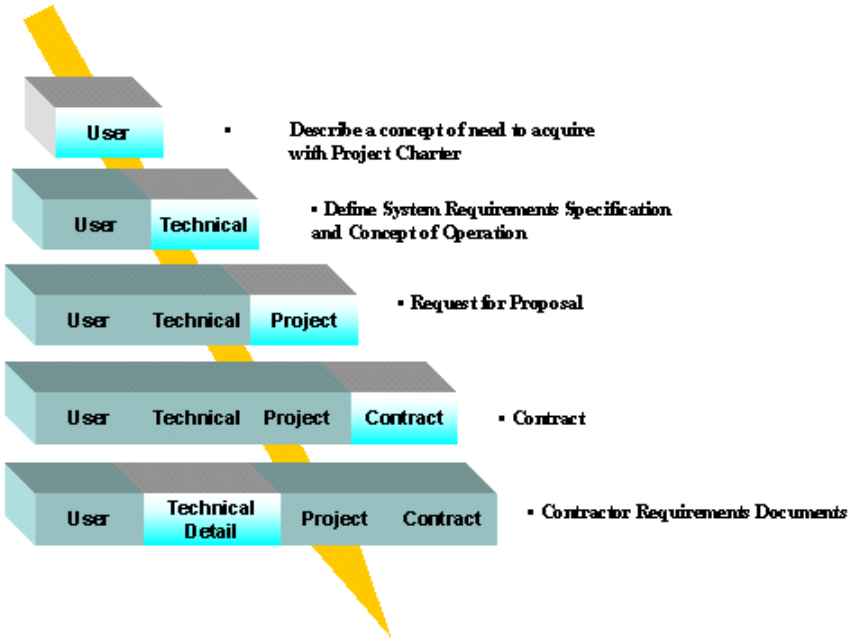
Requirements development is an iterative process of identifying and documenting the system requirements.



1. The process starts in the **Planning phase** when the Project Manager creates the **Project Charter** that defines the project vision and scope. The Project Charter addresses the questions:

a. What are the business objectives for the product?
b. What is the vision of the solution?
c. What is the project scope?
d. Are there any limitations?
e. What are the project success factors?

The Project Charter is for state internal use only and is not part of the contractual requirements. Nevertheless, the charter is a critical part of the requirements process because it provides strategic direction and bounds for the system requirements development. The project staff uses the Project Charter as a reference to ensure subsequent system requirements align with, and enable achievement of the business objectives and project goals.

2. Next the project office develops the contractual system requirements and documents them in the **System Requirements Specification** (SyRS) to be included with the Request for Proposal (RFP). The SyRS sets the scope for the system. To develop the SyRS, the project performs the following steps.

- **Elicitation**
- **Analysis**
- **Documentation**
- **Validation**

According to **IEEE 830** (Recommended Practice for Software Requirements Specifications (SRS)) the requirements specification should address following:

a. **Functionality**. What is the system and software supposed to do? What are the business functions? What data is required to perform those functions? What are the business rules? What forms and reports are produced by the system?
b. **System Performance**. What is the speed, availability, response time, recovery time of various functions, etc.?
c. **Quality Attributes**. What are the considerations for security, correctness, maintainability, and etc?
d. **External Interfaces**. How does the software interact with people, the system's hardware, other hardware, and other software?
e. **Constraints**. Are there design constraints imposed on an implementation? Are there any required standards in effect, implementation language, policies for database integrity, resource limits, operating environment(s), etc.?

TIP **It is very important that the System Requirements Specification (SyRS) define *what* the system must do rather than define *how* the system will be designed and constructed.** (**IEEE 1233** (link to pdf), paragraph 4.1 and **IEEE 830** (link to pdf) paragraph 4.1). Those "how-to" decisions should be made in the design phase of the project. Defining design in the requirements definition could adversely restrict the design solution. **In addition, the system requirements should not contain project requirements such as cost, delivery schedules; reporting procedures, quality assurance, validation and verification criteria and acceptance procedures (i.e., service-type requirements or activities).** (IEEE 830, paragraph 4.8) These items should be included in the Request for Proposal and Statement of Work.

3. A complex project may further define use cases, tasks and scenarios and document the results in a **Concept of Operation**. The ConOps can be included or referenced in the RFP to give the vendor a better sense of how the system will be used.

4. Once a Contractor is selected from the Proposal Evaluation Process, the Contractor analyzes the system requirements and produces additional requirements documentation. Specifically, the Contractor analyzes the requirements in the System Requirements Specification (SyRS) and allocates the requirements to software and hardware components. The Contractor produces a Software Requirements Specification (SRS) that defines the detailed requirements of the software application. The hardware requirements are defined in a System Architecture Specification. Detailed interface requirements may be documented separately in an Interface Control Document (ICD). The system performance requirements are detailed in Capacity and Performance Plans. The Project Office ensures all system requirements from the SyRS can be traced to the Contractor's documented requirements.

The Contractor's documented requirements are typically more detailed than the System Requirements Specification. The Contractor may add requirements derived from the system requirements. Derived requirements can come from logical extensions of system requirements. For example, if the system requirement stated "The system shall be available twenty-two hours a day, seven days a week from 0200 to 2400". Then a derived requirement could be added stating, "batch processing shall be accomplished within a two hour period between 2400 and 0200".

The Contractor's requirements documentation can also clarify requirements. For example, if the system requirement stated that "Diversion payment must be made within a 30-day period", the Contractor may ask the Project Office to clarify the point the 30-day period begins and add a requirement that states, "Diversion payment must be made with a 30-day period that begins from the date of application." However, the Contractor's requirements documentation **shall not add** requirements that change the scope of the project. If the Contractor discovers a significant requirement was omitted or incorrectly stated, they should follow the Project Office's **change control procedures** which allow each change to be properly evaluated for project impact.

Requirements Elicitation

The purpose of the requirements elicitation process is to define:

- System Functions,
- Interfaces,
- Data Models,
- Business Rules
- Forms/Reports
- System Performance Factors, and
- Quality Attributes.

Requirements are defined incrementally by considering business requirements, technology, and constraints. **Click to see illustration** for elicitation (gif).

1. **Identify Business Objectives**. The elicitation process starts with **business objectives**. All use cases and functional requirements must align with, and support the business objectives in the **Project Charter**.

2. **Identify Mandated Requirements**. The project office should gather controlling documents including State and Federal guidelines, policies, regulations, and legislation. System Requirements should be extracted from these documents and **analyzed**.

3. **Develop Use Cases** (optional). Use cases are useful when existing business processes are to be automated. Users are asked to describe their current work processes, data flow, business rules, forms/reports, and interfaces with other agencies. This will allow the project office to define the business functional requirements.

   a. This starts by identifying the **user classes** which may include:

   - Case Workers
   - Field (mobile) Workers
   - Clients or Cases
   - Help Desk Staff
   - General Public
   - System Administrators
   - Database Administrators
   - Network Administrators
   - Software Maintainers
   - Hardware Maintainers
   - Trainers

   b. Then the project office selects **project champions** for each user class. Identify a least one person who can accurately present the needs of each user class, serve as the voice of the customer for that community, and make decisions on its behalf. Project champions must have an ongoing participation in the project and decision-making authority.

c. Next the project office establishes **focus groups** of typical users and meets with them to collect their input on the functional requirements for the new system. Unlike project champions, members of focus groups generally do not have decision-making authority.

d. The user representatives identify and document the use cases.

4. **Requirements Re-use**. The project office may identify characteristics of similar systems or subsystems from other projects within the division or from other states or agencies. This can be done by requesting RFPs, system specifications, or system design documents from systems with similar business objectives. Note that the overall system may not be have the same purpose but may have a component that has similar characteristics. For example, several systems could have similar requirements for security or help-desk support.

5. **Available Technology**.. The project office must consider the impact of technology when preparing requirements. For example, if a new system is required to operate on an existing network, the requirements engineers would consider the available network bandwidth in evaluating operational speed.

   The project office may also consider technology design constraints. For example, if an agency had all of its existing applications in a particular programming language like C++ and a staff of C++ programmers already in place maintaining those applications, the State could mandate that a new application for that agency also use C++.

   It is important to note that ***extreme caution*** should be used in mandating the use of any type of technology because that mandate may unnecessarily constrain design solutions. As stated before, it is preferred to define requirements and let the vendor choose the best technical solution. However, there are cases where the acquirer can mandate a use of a technology if it is the best interest of the State.

6. Identify **System Performance Factors** and **Quality Attributes** for the system. Factors and attributes can be defined from benchmarks, studies of similar systems, modeling/simulation or prototyping.

   There may not be enough information at the time of RFP release for the project office to define key performance factors and quality attributes. In that case, the project can provide business performance requirements such as maximum number of transactions and peak case load and request the vendor determine system performance targets along with justification in their proposal.

   The project office should require the vendor perform additional analysis to validate the targets during requirements definition and refine the estimates as the project progresses through design and implementation. These analyses should be documented in deliverable reports. To help supply information on performance and quality attributes for future projects, it is important that each contract include a requirement for the system to be able to automatically collect and report metrics such as availability and operational speeds.

7. **Identify External Interface Definitions**. Describe how the system must interact with people, other hardware, other software, and other agencies.

8. **Identify Constraints**. In addition to business and technical considerations, the requirements may be affected by other constraints. The constraints may be institutional such as legislation, regulations, policies, or could be physical such as size limitations or operating environment.

9. **Techniques**. The steps above are typically used to define requirements for SID projects; a variety of techniques may be used to gather the information. **IEEE 1233** (link to pdf) (Guide for System Requirements Specifications (SyRS)), paragraph 7.1.1 list the following.

- Structured workshops [including Joint Application Design (JAD) sessions]
- Brainstorming or problem-solving sessions
- Interviews
- Surveys/questionnaires
- Observation of work patterns (e.g., time and motion studies)
- Observation of the system's organizational and political environment
- Market analysis
- Reverse engineering

TIP When gathering information for a requirement, be sure to consider how it will be tested or verified. Determine with the user/stakeholder what the success criteria would be. This will help later when writing test plans and procedures.

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Defining Business Objectives

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Business Objectives originate as a response to legislation or regulation, from a desire to create a new or better system or process, from the need to replace an existing system, or from some other actual or perceived need. All use cases and functional requirements must align with, and support these business objectives.

Objectives tend to be high-level statements of need which describe what is needed in terms of the business context.

The following is an example of a business objective:

> "Child Welfare System/Case Management System (CWS/CMS) is a statewide database and case management system whose primary purpose is to enhance and support the effectiveness of California's Child Welfare Services program. The system is intended to:
>
> - Provide child welfare social work staff with immediate access to child, family, and case specific information in order to make good and timely case decisions;
> - Provide child welfare social work staff with current and accurate information to effectively and efficiently manage their caseloads and take appropriate and timely case management actions;
> - Provide State and County administrators with the information needed to monitor and evaluate the achievement of program goals and administer programs;
> - Provide State and County child welfare agencies with a common database and definition of information from which to evaluate child welfare services;
> - Consolidate the collection and reporting of information for child welfare programs pursuant to State and Federal requirements."

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Requirements - Performance Factors of the System

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As a minimum, all projects should consider the following System Performance Factors as defined in **IEEE 610** (link to pdf), Standard Glossary of Software Engineering Terminology:

- **Operational Speed** to include:
  - Response Time - The elapsed time between the end of an inquiry or command to an interactive computer system and the beginning of the system's response.
  - Port-to-Port Time - The elapsed time between the application of a stimulus to an input interface and the appearance of the response at an output interface.
  - Think Time - The elapsed time between the end of a prompt or message generated by an interactive system and the beginning of a human user's response.
  - Turnaround Time - The elapsed time between the submission of a job to a batch processing system and the return of completed output.
- **Capacity** to include:
  - Throughput - The amount of work that can be performed by a computer system or component in a given period of time; for example, number of jobs per day.
  - Memory Capacity - The maximum number of items that can be held in a given computer memory; usually measured in words or bytes.
  - Channel Capacity - The maximum amount of information that can be transferred on a given channel per unit of time; usually measured in bits per second or in baud.
  - Storage Capacity - The maximum number of items that can be held in a given storage device; usually measured in words or bytes.
- **Availability**. The degree to which a system or component is operational and accessible when required for use. Often expressed as a probability.
- **Back up and Recovery Times**. The time it takes a system, component, file, procedure, or person available to replace or help restore a primary item in the event of a failure or externally caused disaster. This includes preparation for a possible failure by performing backups.

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Requirements - Quality Attributes of the System

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When writing system requirements, the following quality attributes of the system should be considered:

- **Security** - Requirements concerning the security maintenance and privacy protection including protection of the physical environment in which the system or software item is required to operate, the type and degree of security or privacy protection of the data, security/privacy risks the system is to withstand (e.g., unauthorized access), required safeguards to reduce those risks, security/privacy policy that is required to be met, the security/privacy protection accountability required, and the criteria that are required to be met for security/privacy protection certification/accreditation. (Defined in IEEE J-Std-16, paragraph 3.7)
- **Reliability** - The ability of a system or component to perform its required functions under stated conditions for a specified period of time.
- **Maintainability** - (1) The ease with which a software system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment. Also: extendibility; flexibility. (2) The ease with which a hardware system or component can be retained in, or restored to, a state in which it can perform its required functions.
- **Data Integrity** - The accuracy of the data managed by the system. Requirements associated with minimizing data entry errors, data corruption, and duplicate files.
- **Ease of Distribution** - The ease with which a system or component can be distributed to users; the amount of effort needed to distribute fixes and new system releases. (not defined in IEEE)
- **Usability** - The efficiency of the system to meet user requirements; the ease of use.
- **Trainability** - The ease of which a user can be trained to use the system; the amount of training and complexity of the courses.
- **Total Cost of Ownership** - Total cost of staff and other resources to develop, operate, and maintain the system over its entire life cycle. Be sure to consider technology refresh needs such as upgrading hardware, operating systems and database systems.
- **Safety** - Requirements to prevent or minimize unintended hazards to personnel, property, and the physical environment.

Requirements Analysis

Req Main

During requirements Analysis, the project office categorizes and prioritizes the requirements. Categorization helps group requirements into logical entities for planning, reporting, and tracking. For example, the requirements are typically grouped by business function in the System Requirements Specification (SyRS).

Prioritization establishes the relative importance and risk of each requirement to help the Project Office effectively manage the project. For example, during requirements development, a requirement that is rated as low priority with low feasibility that may be very costly to implement may be omitted. In another example, a requirement with high priority and high technical difficulty may prompt the project manager to request a study of potential solutions.

Typically the requirements are stored in a database tool where categorization and prioritization fields can be added as needed. The fields typically include:

- **Unique Identifier** - A hierarchical numbering scheme.
- **Business Function Identification** - The project can have a secondary identification by business function that can also be hierarchical like CASE.FORM.PRINT. The functions will be project specific.
- **Type** - (see below)
- **Priority** - (see below)
- **Difficulty** - (see below)
- **Feasibility** - (see below)
- **Stability** - (see below)
- **Risk** - (see below)
- **Source**. Project specific sources. For example it could be a particular source document (such as legislation) or user need identified during a workgroup.

The categorization by **type** will help organize the requirements into logical groups for presentation in the System Requirements Specification. The categories can be used in subsequent proposal evaluations and work product reviews to summarize how well the proposed solution meets the requirements in the stated categories. IEEE 1233 (Guide for Developing System Requirements Specifications (SyRS)), recommends the following types:

- Input (e.g., receive EDI data);
- Output (e.g., export a particular format);
- Reliability (e.g., mean time to failure);
- Availability (e.g., expected hours of operation);

- Maintainability (e.g., ease with which components can be replaced);
- Performance (e.g., response time);
- Accessibility (e.g., different navigation paths for novice and experienced users);
- Environmental Conditions (e.g., dust levels that must be tolerated);
- Ergonomic (e.g., use of particular colors to reduce eye strain);
- Safety (e.g., below specified limits for electrical magnetic radiation);
- Security (e.g., limits to physical, functional, or data access, by authorized or unauthorized users);
- Facility Requirements (e.g., power requirements);
- Training (e.g., includes tutorials or computer-based training);
- Documentation (e.g., on-line help facility);
- External Interfaces (e.g., support for industry standard communication mode/format);
- Testing (e.g., support for remote diagnostics);
- Quality Provisions (e.g., minimum required calibration intervals);
- Policy and Regulatory (e.g., environmental protection agency policies);
- Compatibility to Existing Systems (e.g., uses digital telephone system as default mode);
- Standards and Technical Policies (e.g., products to conform to IEEE standard);
- Conversion (e.g., will accept data produced by older versions of system);
- Growth Capacity (e.g., will support an additional number of users);
- Installation (e.g., ability to put a new system into service).

Priority communicates the implementation priority for each requirement. The objective is to make sure work products deliver the most essential functionality as early as possible. Prioritization provides the Project Office important guidance in planning the project. Priorities are especially useful in an incremental development where you need to decide which functions to include in each build.

Prioritization can also be used to adjust work plans once the project is under way. If difficulties arise, it may become necessary to defer or drop low-priority requirements to meet schedule deadlines. Or if new requirements are needed, their implementation can be considered in relation to existing requirements. Typically the priority levels are:

High – Essential to meeting business objectives and must be implemented immediately.
Medium – Important to meeting business objectives. Eventually required, but can be implemented after highest priority requirements.
Low – Enhances the business operation or product quality. Nice to have someday if resources permit.

Difficulty rates the technical complexity of the requirement. This rating is will be assessed by the Project Office but not provided to the vendor or included in the RFP. It will be used internally to prioritize review, test, and evaluation. The vendors will evaluate difficulty in their own requirements analysis. The difficulty ratings typically are:

High – Very complex

Medium – Moderately complex
Low – Simple

Feasibility rates the probability of the requirement being successfully achieved. In other words, the "do-ability" of the requirement. Evaluating the feasibility of each requirement helps identify unreasonable requirements or those requirements that might take longer than planned. A requirement can have low feasibility for a number of reasons including limits in technology, political environment, and operating environment including skills of available work force. The project may want to reconsider requirements with low feasibility. The requirement may need to be deleted or reworked to increase its tolerances. If the requirement is essential as is, the project manager may commit additional resources to study solutions and alternatives to improve its feasibility. The feasibility ratings typically are:

High – High probability of being achieved
Medium – Medium probability of being achieved
Low – Low probability of being achieved

Stability can be expressed in terms of the likelihood of expected changes to any requirement based on experience or knowledge of forthcoming events that affect the organization, functions, and people supported by the software system. Examples of such events include political negotiations, proposed legislation or change regulations. The ratings typically are:

High – High probability of changing
Medium – Medium probability of changing
Low – Low probability of changing

Risk identifies requirements that have a high probability of adversely impacting the project. Requirements may have issues that may become a problem for the project. The issues may be internal or external. Internal issues originate within a project like probable requirement failure and the inability to obtain a subject area expert. The external issues originate outside the project like new regulations, legislation or protest from special interest groups.

The IV&V team usually has overall responsibility for administration of the project risk management program and will assign risk ratings as part of the requirements validation. The IV&V team may consider the Project Office's ratings for priority, difficulty, feasibility, and stability in making their assessment. The risk ratings typically are:

High – High probability of negative impact on project
Medium – Medium probability of negative impact on project
Low – Low probability of negative impact on project

Overall, analyzing the requirements helps project office give more careful consideration to each requirement, which often identifies hidden assumptions. Ranking also helps developers make correct design decisions and devote appropriate levels of effort to the different parts of the system.

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Requirements Documentation

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The project office documentation from the requirements definition process should include:

- **System Requirements Specification** (SyRS)

In addition, the project office may also produce:

- **Concept of Operation** (ConOps)
- **Interface Requirement Specification** (IRS)

The system requirements usually are recorded in a **requirements database/tool** that is used to manage requirements and assist in the production of requirements documentation. TIP Follow these **tips for writing good requirements**.

Once the contract is awarded, the Contractor typically produces:

- Software Requirements Specification (SRS)
- System Architecture Specification
- Interface Control Document (ICD)
- Capacity and Performance Plans

Tips for Documenting Requirements

Here are some tips for writing good requirements:

- Indicate **WHAT** must be done, not **HOW** it must be done.
- Use action verbs, not passive voice.
- Use "shall" and "must" if something must be done (a requirement); use "should" or "may" if something is optional (i.e., you can live without it).
  - "Will" can be unclear.
- Don't use different words for the same thing.
  - "input data", "enter data", "type data", "key-in data"
  - "search", "filter", "query", "sort", "report"
- Don't use the same words for different things.
  - "generate a report", "generate an error", "generate a display"
- Don't use vague, undefined, or un-quantifiable terms
  - "user-friendly" or "easy to use"
  - "reasonable response time" or "available"
  - "large cases" or "large number of cases"
  - "support" or "allow"
- Does the requirement clearly indicate:
  - Who does What by When and Where it must be performed
  - If there is a required format, what the format is or where to find it?
  - Why this is important? What is the context?

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Requirements Validation

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The SyRS must be validated to ensure it meets the characteristics of good SyRS. The IV&V vendor usually has responsibility to validate the system requirements for the project office. The IV&V should provide a report of validation results before the RFP is released. If requirements are added or changed after the RFP is released, IV&V should validate the new or changed requirements. Often, the customer or user helps to determine if the SyRS correctly reflects their actual needs (i.e., the needs were clearly communicated and documented).

The validation should ensure the documented requirements have the following characteristics as defined in **IEEE 830** (ink to pdf), (Standard for Software Requirements Specifications (SRS)), paragraph 4.3:

- Correct;
- Unambiguous;
- Complete;
- Consistent;
- Ranked for importance and/or stability;
- Verifiable (testable);
- Modifiable;
- Traceable.

An SyRS is correct if, and only if, every requirement stated therein is one that the software shall meet. There is no tool or procedure that ensures correctness. The SyRS should be compared with other applicable specifications, with other project documentation, and with other applicable standards, to ensure that it agrees. **Backwards traceability** is verified and helps to ensure all requirements trace to a specific source (i.e., there is a reason and a need for each requirement).

TIP When considering testability, also consider the amount and type(s) of testing that will be needed to verify the requirement. This information should be included in the Test and Evaluation Plan. Determine what the success criteria are? How much testing is "good enough"?

TIP Remember that there may be some requirements that are difficult to test. Determine the cost-benefit for the desired tests. How much testing is warranted given the cost to perform the tests. This is often an issue for failure recovery requirements.

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Requirements Traceability

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Requirements traceability deals with ensuring all requirements have been fulfilled in the end product. Bi-directional traceability (tracing both to a source and subsequent work products) is essential for ensuring only the desired functionality has been implemented. **Backwards** traceability involves verifying the source of the requirement. Typically this is legislation, regulations, business policy or user needs identified from a workgroup session. Requirements from the RFP and contract are traced **forward** to the contractor's design, code and various levels of **testing documents**. It is important that traceability be verified at the completion of each major phase (e.g., design, code, unit test, etc.) to ensure no requirements have not been overlooked or accidentally omitted. (**Click here** for a PDF example of traceability.)

In some cases, requirements may difficult or infeasible to test (e.g., recovery from a database mirroring failure). These requirements may be satisfied through inspection of code modules, review of product literature, or certification by the vendor. Some requirements may require several types of tests to verify it has been completely implemented.

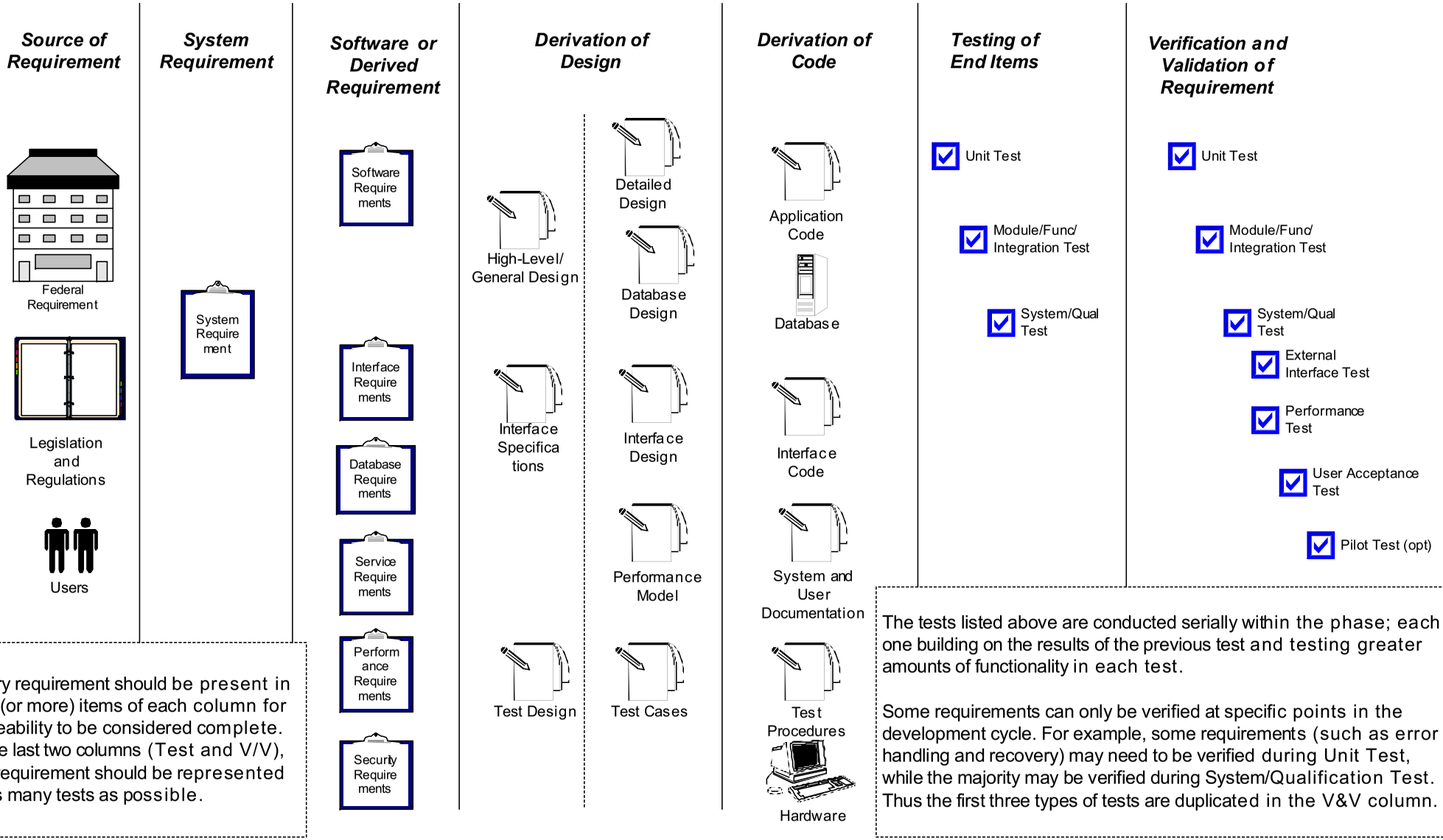
In some cases, a requirement may trace to several areas of the code or several different functions. In this case, each area or function would be considered a partial trace. All of the partial traces must be verified/tested before traceability for that requirement can be considered complete.

Traceability is typically performed by the project office prior to contract award. After contract award, the administration of traceability may be delegated to the contractor or to the IV&V vendor. However, the project office remains responsible for ensuring traceability is complete and holding the vendor responsible for any traceability issues or problems.

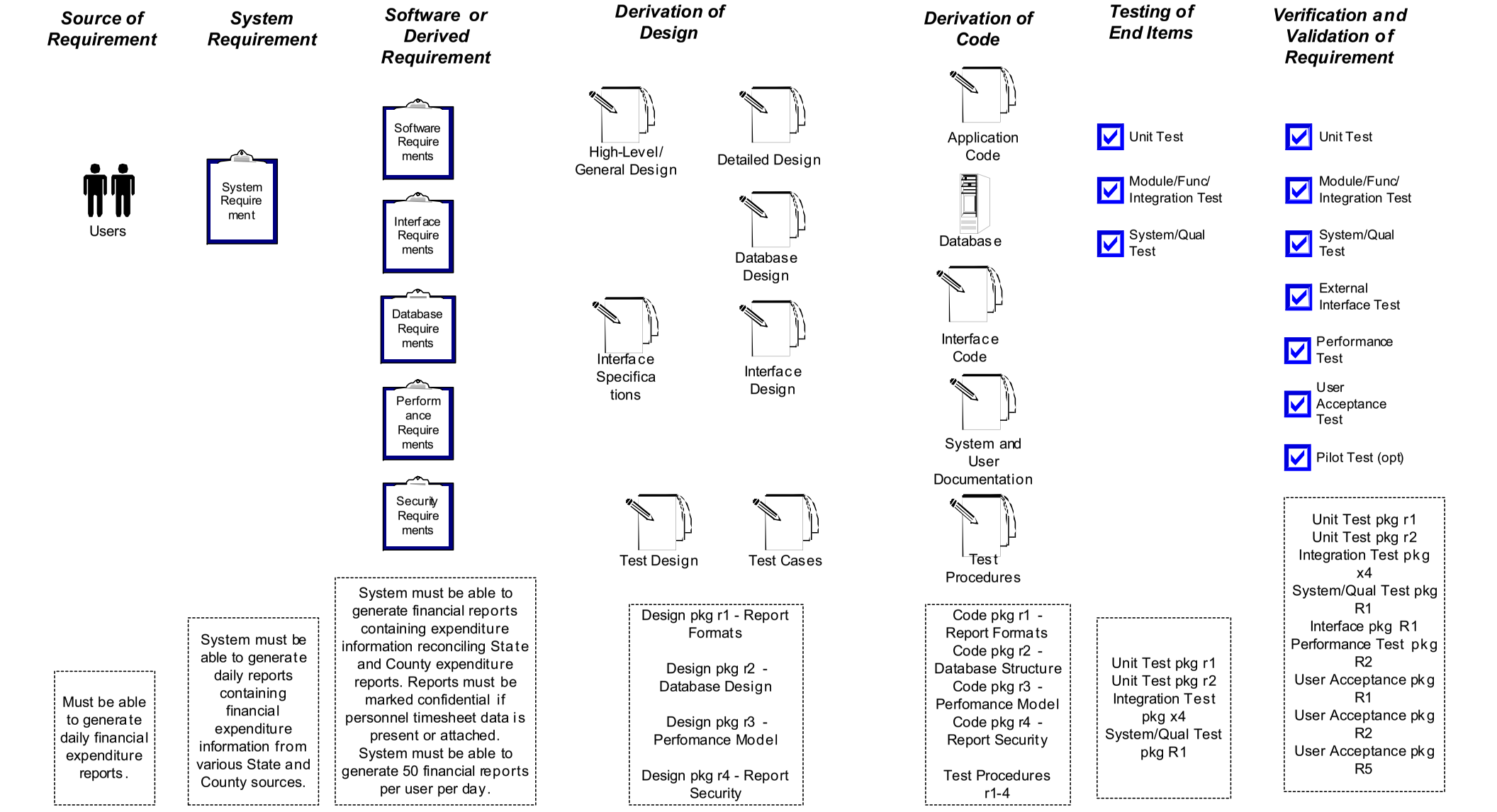
Samples

- **EBT Requirements Traceability Plan** (MS Word)
  - **Appendix A - RequisitePro Schema** (MS Word)
  - **Appendix B - Baseline Operational Requirements** (MS Word)
  - **Appendix C - Contract Requirements** (MS Word)

Requirements Traceability



Example of Requirements Traceability



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Requirements Change Control

Req Main

Requirements are rarely static. Although it is desirable to freeze a set of requirements permanently, it is rarely possible. Requirements that are likely to evolve should be identified and communicated to customers and the technical staff. A core subset of requirements may be frozen (baselined) early.

The impact of proposed new requirements must be evaluated to ensure that the initial intent of the requirements baseline is maintained or that changes to the intent are understood and accepted by the customer.

TIP Often identifying there is a requirements change is the hardest part. Be sure to consider the impact to requirements for ALL changes. Treat the requirements document as a living document and refer to it frequently when analyzing change requests.

According to IEEE 1233, "if any changes to the SyRS baseline are to be made, they should be controlled through a formal change management process. This process should include appropriate negotiation among parties affected by the change and should trigger pertinent risk assessments (e.g., schedules or costs)."

The requirements change control process for projects should include:

1. The Configuration Manager puts the baselined System Requirements Specification under Configuration Control in the Configuration Management Library and ensures the baseline has been set in the Requirements Management tool.
2. A staff member submits a written Requirements Change Request form to Configuration Manager. The Configuration Manager ensures the form is properly completed.
3. The Configuration Manager forwards a copy of the Requirements Change Request to the Requirements Engineer to evaluate the change request by assessing its merit, feasibility, priority, and risk to include impact on cost and schedule. The Requirements Engineer will contact affected parties as needed to perform the assessment, and/or will run reports from the Requirements Management tool to identify affected areas. The results of the evaluation are recorded on the Requirements Change Request form.
4. If a requirement creates conflict or concern among affected parties, the Requirements Engineer may meet with affected parties to negotiate a compromise. The discussion and decisions shall be recorded in meeting **Minutes**. The Requirements Engineer should record any negotiated modifications on the Requirements Change Request form.
5. A Configuration Control Board (CCB) should be convened periodically to accept or reject the change requests for requirements. The Configuration Manager records the decisions in the CCB minutes. The Configuration Manager records the approval status of each change request on the Requirements Change Request form.
6. If approved, the Configuration Manager gives the change requests back to the Requirements Engineer who updates the requirements in the Requirements Management tool and notifies all affected parties. The Requirements Engineer records the disposition of each implemented change request on the Requirements Change Request form.
7. All change requests forms are filed and controlled by the Configuration Manager.

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

Column 1 lists the expectations for the phase. The remaining columns indicate the expected reviewers (for the Deliverables and Interim Work Products section), or the participants (for the Activities/Decisions and Reviews/Meetings section).

Legend:

P – Primary Responsibility

S – Support Discussions/Activity, as needed

R – Reviewer

A - Approver

I – For Information Only

MILESTONE EXPECTATIONS	PROJECT OFFICE MGMT	PROJECT OFFICE CONTRACT MANAGER	PROJECT OFFICE SYSTEMS ENGRING	PROJECT OFFICE QUALITY ASSURANCE	PROJECT OFFICE IMPLMNTN TEAM	PROJECT OFFICE BUSINESS/ INDUSTRY CONSULTANTS	PROJECT OFFICE LEGAL SUPPORT	STAKEHOLDERS/ USER REPS	INDEPENDENT VERIFICATION AND VALIDATION	PRIME CONTRACTOR
Deliverables[1]										
System Requirements Specification (SyRS)	A		R	R	R	R		I	R	P
Interface Requirements Specification (IRS)	A		R	R	R	R			R	P
Logical Data Model	A		R	R		R			R	P

[1] Final versions of deliverables required for exit of this phase.

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

Milestone Expectations	Project Office Mgmt	Project Office Contract Manager	Project Office Systems Engring	Project Office Quality Assurance	Project Office Implmntn Team	Project Office Business/ Industry Consultants	Project Office Legal Support	Stakeholders/ User Reps	Independent Verification and Validation	Prime Contractor
Implementation Plan	A		R	R	R	R		R	R	P
Site Preparation Plan	A		R	R	R	R		R	R	P
Equipment Installation/ Delivery Plan	A		R	R	R	R		R	R	P
Transition Plan	A		R	R	R	R		R	R	P
BPR Approach Plan/Charter	A/P		R	R	R/P/S	R		R	R	P/S/R
BPR Current System Analysis	A/P		R	R	R/P/S	R		R	R	P/S/R
Change Leadership/ Organizational Change Plan	A		R	R	R	R		R	R	P
Training Plan	A		R	R	R	R		R	R	P
Operations Support Plan	A		R	R	R	R		R	R	P
Maintenance Plan	A		R	R	R	R		R	R	P
Help Desk Plan	A		R	R	R	R		R	R	P

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

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System Architecture Design Description (SADD)	A		R	R	R	R		R	R	P
System Interface Design Description (SIDD)	A		R	R	R	R		R	R	P
Integration/ Interface Mgmt Plan	A		R	R	R	R		R	R	P
Software Requirements Specification (SRS)	A		R	R	R	R		R	R	P
Software Interface Requirements Specification (if applicable)	A		R	R	R	R		R	R	P
Database Requirements Specifications (if applicable)	A		R	R	R	R		R	R	P
Updated Workplan	A		R	R	R	R			R	P

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

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Updated Capacity/ Performance Model	A	I	R	R	R	R			R	P
Concept of Operations	A		R	R	R	R		S	R	P
Interim Work Products[2]										
System Test Preliminary Plan			R or S	R	R			I	R	P or S
Data Conversion Preliminary Plan			R	R	R			I	R	P
Reverse Engineering Analysis			R	R		R		I	R	P
Use Cases			R	R		R		I	R	P
Business Context Model			R	R		R		I	R	P
Business Process Modela			R	R		R		I	R	P
Physical Data Model			R	R		R		I	R	P

[2] Deliverables which may be in draft form at exit of this phase or which will be expanded in a future phase based on further information (e.g.: preliminary plan vs. final plan).

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

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Data Flow Diagrams			R	R		R		I	R	P
Screen/Report Layouts			R	R		R		R	R	P
Screen Navigation Maps			R	R		R		R	R	P
Screen/Report Prototypes			R	R		R		R	R	P
Activities/Decisions										
Determine the volume and workflow for Notice of Action type notifications.	A		S	R	I	R		S	R	P
Verify assumptions for the phase are still valid.	A	I	S	S	S	S	S	S	R	P
Validate the Capacity/ Performance Model assumptions and calculations.	A		R	R	I	R		I	R	P

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

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Re-validate Deliverable Expectation Documents prior to vendor beginning work on each deliverable.	A	P	P	R	R	R		R	R	R
Validate the standards for code unit/module size (function points or lines of code), transaction timing, and timing budgets per functional area and/or code unit.	A		R	I		R		R	R	P
Verify the critical requirements are identified (those which must be satisfied or the system will not be accepted).	A	R	P	R	R	S		S	R	S

System Development Contractor Oversight

Responsibility Assignment Matrix

Milestone #2 – Requirements Completed/Approved

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Verify there are requirements for maintenance and operations, and systems administration, and that there are testable criteria for verifying these requirements.	A	R	P	R	R	R		S	R	S
Verify traceability of the requirements to the RFP and requirements tool.	A		R	R					R	P
Upon approval of the requirements, baseline the requirements/ requirements tool contents.	A			I					R	P
Reviews/Audits										

System Development Contractor Oversight

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Deliverable Review Meetings (see participants for each deliverable listed above)	P						S		R	P
Requirements Analysis Mtgs			S	S	I	S		S	I	P
Systems Requirements Review Mtg (mini-milestone)	A	I	S	S	I	S	S	S	R	P
Architecture Review Meeting (mini-milestone)	A	I	S	S	I	S	S	S	R	P
Software/ Application Requirements Review Mtg (mini-milestone)	A	I	S	S	I	S	S	S	R	P
QA/CM Audit	A	I	S	S	I				R	P
Phase Closeout Meeting	A	S	S	S	S	S	S	I	R	P